METHOD FOR CONSTRUCTING A MULTISTORY BUILDING

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the benefit of U.S. Provisional Application Serial No. 60/273,374, filed March 5, 2001, entitled Method for Constructing a Multistory Building, which is incorporated herein by reference.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not applicable.

BACKGROUND OF THE INVENTION

[0003] The present invention relates to a method for constructing a building using poured-in-place concrete-tunnel construction methods. The present invention is especially applicable to buildings having a distinct superstructure and substructure. More particularly, the present invention provides a method for constructing such a building without the need for a load transfer deck. Still more particularly, the present invention relates to a method for spacing and extending load-bearing walls in the superstructure and the substructure such that load-bearing members in both structures are vertically aligned.

[0004] Construction of buildings using tunnel forming has been utilized for many years in the construction of multistory concrete buildings. Tunnel forming allows the walls and floor of a certain level of the building to be poured simultaneously. This method greatly reduces the costs associated with multistory concrete construction. There are many structures used in the tunnel forming process, such as those that are described in U.S. Patents Nos. 4,439,064, 4,261,542, and 3,979,919, each of which is incorporated herein by reference.

[0005] When designing and constructing multistory structures it is often desired to incorporate several levels of parking spaces into the structure. As an example, it has become commonplace to construct buildings in which several floors of residential units are constructed above some number of floors of parking garage. The architect or designer must take into account the load bearing requirements of both the parking garage and of the residential units. The limitations on the arrangement of load-bearing members in a parking garage are very different from the limitations on the arrangement of load-bearing members in a series of residential units.

[0006] Parking garages must typically provide accessible parking spaces in units that are approximately equal to an integral multiple of a standard car width. In order to avoid excess costs associated with larger spans, the integral multiple is typically small, *e.g.* two or three. Thus, relatively inexpensive parking garages will have parking bays that are two or three car widths wide. In addition, wide access lanes are needed to allow cars to enter and exit the parking spaces. In addition, it is often desirable for security reasons to allow transverse visual access to the parking bays. Thus, there are several mechanical, cost, security, and other constraints on the positioning of vertical load-bearing members in a parking garage.

[0007] At the same time, it is often desirable to configure residential units in a manner that is not constrained by the configuration of the load-bearing members in levels below the residential unit. If the layout of the load-bearing members in the residential structure does not vertically align with the layout of the load-bearing members in the underlying parking structure, it is necessary to provide a transfer deck.

[0008] Transfer decks are well known in the art and comprise rigid planar structures that allow vertical loads to be transferred from load-bearing members on one side of the transfer deck to non-vertically-aligned load-bearing members on the other side of the transfer deck. Because the

transfer deck is subjected to very large shear and bending forces, it is typically quite massive and therefore expensive.

[0009] A primary objective of one embodiment of the present invention is to eliminate the transfer deck therefore decreasing costs of construction.

[0010] Another objective of one embodiment of the present invention is to provide advantageous layouts to both a parking garage and to residential units while keeping load-bearing members in vertical alignment.

[0011] Yet another objective of one embodiment of the present invention is to reduce the costs associated with construction of a building that integrates a substructure and a superstructure with substantially different configurations.

[0012] Still another objective of the present invention is to provide a building system in which the substructure and the superstructure utilize the same construction methods and materials (forms), thus further reducing costs and time of construction and making it possible for a single work team to construct the entire building.

SUMMARY OF THE INVENTION

[0013] According to a preferred embodiment, a multistory building can be built without a transfer deck even when it is desired to provide very different configurations in the substructures and superstructures. For example, in the case of a building having a parking garage as its substructure and residential units as its superstructure, the present invention makes it possible to avoid the expense of a transfer deck, while providing desirable residential configurations and a maximum number of parking units per unit area.

[0014] The present invention makes it possible to provide advantageous layouts to both a parking garage and to residential units while keeping load-bearing members in vertical

alignment. The present invention also provides a building system in which the substructure and the superstructure utilize the same construction methods and materials (forms), thus further reducing costs and time of construction and making it possible for a single work team to construct the entire building.

[0015] In a preferred embodiment of the present invention, the load-bearing members in the residential structure (hereinafter "upper load-bearing members") are aligned vertically, as is well known in the art. At the same time, load-bearing members in the parking structure (hereinafter "lower load-bearing members") are vertically aligned with the upper load-bearing members. However, instead of providing continuous support along the length of each upper load-bearing member, the lower load-bearing members are configured to provide columnar support. Correspondingly, the upper structure is provided with an interface level as its lowest level. The load-bearing members at the interface level are configured to span the columnar supports provided by the lower load-bearing members. In this manner, the present invention provides the versatility of a column-and-plate structure (such as is provided by a transfer deck), but at the lower cost of a load-bearing system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] For an introduction to the detailed description of the preferred embodiments of the invention, reference is made to the following accompanying drawings wherein:

Figure 1 is a plan view of a representative first floor of a building having a substructure configured as a garage and constructed in accordance with the present invention;

Figure 2 is a plan view of a representative second floor of the building of Figure 1 having a superstructure configured as residential units;

Figure 3 is a plan view of a representative third floor of the building of Figures 1 and 2;

Figure 4 is an elevation of the building of Figures 1-3, illustrating the tunnel configuration;

Figure 5 is an elevation of a section view, taken along section line 5' of Figure 4, of a structure through a vertical support; and

Figure 6 is an elevation of a section view, taken along section line 6' of Figure 4, of a structure through another vertical support.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0017] The present invention provides for the vertical transmission of loads through a superstructure and into a substructure while allowing both the sub- and superstructures to be configured in a cost effective and desirable manner. In addition, the present invention eliminates the need for a transfer deck, thereby significantly reducing the cost of structures built according to the invention.

[0018] Referring now to Figure 1, the columnar nature of load-bearing members around the perimeter of the parking level can be seen. Specifically, the perimeter of the parking level is provided with a plurality of double-column supports 12 interspersed with a plurality of single-column supports 18. Each double-column support 12 comprises an inner support 14 and an outer support 16. A plurality of inner linear load-bearing members 20 is provided along the main axis 17 of the structure. Referring now to Figure 2, the interface level, which comprises the lowest level or levels of the upper structure, is provided with a plurality of upper linear load-bearing members 30 interspersed with a plurality of wall beams 40. At their respective inner ends, upper load-bearing members 30 and wall beams 40 are vertically aligned with inner load-bearing members 20. At their respective outer ends, upper linear load-bearing members 30 are vertically aligned with inner supports 14, while wall beams 40 are vertically aligned with single-column supports 18.

[0019] This configuration allows both the parking and residential portions of the structure to be constructed using concrete "tunnels" as are known in the art and disclosed and described in the U.S. Patents mentioned above. The tunnel configuration can be clearly seen in Figure 4. The use of poured-in-place concrete tunnels reduces the time and cost required for construction. Each tunnel extends from the main axis 17 to the perimeter of the structure, so that each level is formed by a plurality of side-by-side tunnels, which may or may not have identical lengths. As can be seen, the tunnels forming the interface level are as long as the tunnels forming the parking level, Figures 1 and 2, while the tunnels forming the levels above the interface level are shorter (Figure 3). In a preferred embodiment, all but one of the walls of the tunnels forming the interface level is shortened, thereby providing the extending wall beams 40. If desired, only the side walls of the tunnels forming the interface level could be as long as the parking level tunnels. By shortening some of the side walls, a larger, roofless terrace 54 is formed between each extending wall beam 40.

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~~[0020] In reference to Figures 5 and 6, in a preferred embodiment, the wall between two adjacent tunnels on the parking level is opened below each wall beam 40. The opening preferably extends to less than the full height of the tunnel, so that the portion of the wall above the opening forms a beam 56. The opening formed in this manner provides both a drive aisle 50 and an unobstructed three-car bay 60. Similarly, separate openings are left in each tunnel side wall. One opening forms drive aisle 50 and the other opening 52 allows transverse visual access along the bays. Openings 52 can extend from floor to ceiling, if desired, whereas it is preferred that the height of the opening be limited so that a beam 58 is left in each tunnel to span drive aisle 50. As is shown in Figure 1, in one embodiment, it is preferred to alternate one-car bays with three-car~~

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bays, resulting in each pair of upper linear load-bearing members 30 being separated from the next by a single wall beam 40.

[0021] A system constructed in this manner maximizes the number of parking spaces that can be provided under a separate structure, without necessitating a costly transfer deck. It will be understood that the concepts disclosed herein can be expanded or modified to provide any number of configurations. By opening the side walls of the tunnels and controlling the height of the openings, and providing an interface level that includes spaced wall beams, the versatility of tunnel construction is greatly enhanced.